Quiz 1 (Chapter 12)

Name:_____

	Zero-Order	First-Order	Second-Order
rate law	rate = k	rate = $k[A]$	rate = $k[A]^2$
units of rate constant	$M\,s^{-1}$	s^{-1}	$M^{-1}\,s^{-1}$
integrated rate law	$[A] = -kt + [A]_0$	$\ln[A] = -kt + \ln[A]_0$	$\frac{1}{[A]} = kt + \left(\frac{1}{[A]_0}\right)$

Arrhenius Equation: $k = Ae^{-E_a/RT}$

1. Consider the following reaction in aqueous solution:

$$A + 2B \rightarrow C + D$$

a) Write the equation that relates the rate expressions for this reaction in terms of the disappearance of A and the disappearance of B.

b) If the rate of disappearance of A at a particular moment during the reaction is 1.4×10^{-4} mol L^{-1} s^{-1}, what is the rate of disappearance of B at that moment?

2. The following data have been determined for the reaction:

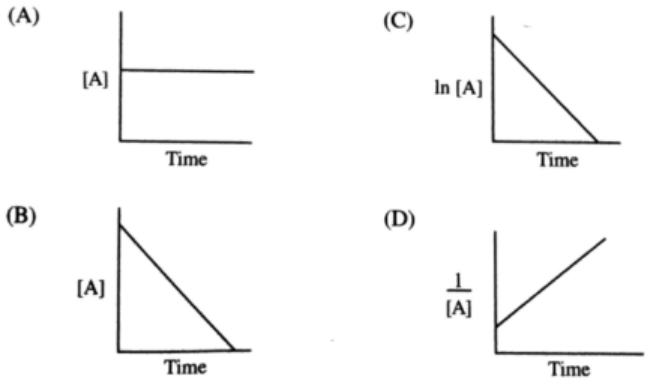
$$2NO + Br_2 \rightarrow 2NOBr_2$$

	[NO] initial (M)	**[Br_2] initial (M)**	**Rate (mol L^{-1} s^{-1})**
1	0.02	0.02	9.6×10^{-2}
2	0.04	0.02	3.8×10^{-1}
3	0.02	0.04	1.9×10^{-1}

Determine 1) the rate law and 2) the rate constant for this reaction.

3. Which of the following graphs may have been created using the data gathered from the following reaction? Assume this is a single step reaction:

$$2A \rightarrow B + C$$



4. Dinitrogen pentoxide gas decomposes according to the equation: $2\ N_2O_{5(g)} \rightarrow 4\ NO_{2(g)} + O_{2(g)}$. The first-order reaction was allowed to proceed at 40.0 °C. The initial concentration of N_2O_5 was 0.400 M and after 20.0 minutes, the concentration changed to 0.289 M.

(a) Calculate the rate constant for the reaction.

(b) After how many minutes will $[N_2O_5]$ be equal to 0.350 M?

5. The rate constant at 550 °C for the decomposition reaction $2H_2O2 \rightarrow 2H_2O + O_2$ is $6.0 \times 10^{-7}\ s^{-1}$, and the frequency factor (A) is $1.2 \times 10^{12}\ s^{-1}$. Determine the activation energy for the reaction.

6. At 600 K, compound A decomposes to form compounds B and C via a first-order reaction. Discuss the effect of each of the following conditions on the half-life of A:

(a) Increasing the initial concentration of A

(b) Increasing the temperature at which the reaction occurs

7. Consider the following:

$2NO_{(g)} \leftrightarrow N_2O_{2(g)}$	(fast, k_1 represents the forward rate constant, k_{-1} the reverse rate constant)
$N_2O_{2(g)} + H_{2(g)} \rightarrow N_2O_{(g)} + H_2O_{(g)}$	(slow, k_2 the rate constant)
$N_2O_{(g)} + H_{2(g)} \rightarrow N_{2(g)} + H_2O_{(g)}$	(fast, k_3 the rate constant)

(a) Write the overall reaction.

(b) Identify all intermediates.

(c) Write the overall rate law.